

Unit 5. EXERCISES

pag 88.-

- 1) By crossing two homozygous individuals we can conclude -in today's words- that there is an allele hidden under the influence of the other allele.
- 2) The dominant allele determines the phenotype of an heterozygous
The recessive allele is hidden in an heterozygous genotype
Two alleles are co-dominant if the heterozygous phenotype is different from the phenotypes of either one homozygous or the other.
- 3) a.-gene; b.-genes; c.- alleles / gene; d.- alleles; e.- alleles
- 4) a1; b2; c4; d2
- 5) genotype / environmental / cell / external / genes
- 6) a false; b true; c true -but only referring to non-linked genes; the law doesn't apply to linked genes, two genes in the same chromosome-
- 7) equal – co-dominant - intermediate
- 8) Regarding second Mendel's law for co-dominant alleles
F1) $Rr \times Rr$
F2) $\frac{1}{4} RR$ (red); $\frac{1}{2} Rr$ (rose); $\frac{1}{4} rr$ (white)
(instead of the proportion 3:1, in case of co-dominant alleles the proportion is 1:2:1)
Regarding co-dominant alleles each genotype corresponds to one phenotype
- 9) A/a are symbols for one trait; L/l are symbols for another trait
Each gamete has to carry information for all traits but each gamete only carries one single information for each trait -one allele of each trait-
- 10) a.- white; b.- nn because white is the recessive allele;
c.- possible parents:
either $nn \times Nn$ (white x black)
or $Nn \times Nn$ (black x black)
or $nn \times nn$ (white x white)
- 11) a.- Referring to a diheterozygous individual and to non-linked genes, four types of gametes the same probability each (gametes $\frac{1}{4} AL$, $\frac{1}{4} Al$, $\frac{1}{4} aL$, $\frac{1}{4} al$)
b.- I guess the question refers to the third Mendel's law.
F2 descendants' phenotypes $\frac{9}{16}$ dominant dominant phenotype
 $\frac{3}{16}$ dominant recessive phenotype
 $\frac{3}{16}$ recessive dominant phenotype
 $\frac{1}{16}$ recessive recessive phenotype
-I'm referring to one trait and the other-
- 12) c) and e) are false. The traits he chose can't have been at random because he must have encountered linked genes. The 88 traits he chose were non-linked genes (what a coincidence! He must have rejected a lot of experiments with other traits)
- 13) I guess $8 = 2 \times 4$
 $a1a1$, $a1a2$, $a1a3$, $a1a4$, $a2a2$, $a2a3$, $a2a4$, $a3a3$, $a3a4$, $a4a4$
- 14) Key: A_1 , A_2 , a
Genotypes: A_1A_1 , A_1A_2 , A_2A_2 , A_1a , A_2a , aa ; 4 different phenotypes (A_1A_1 and A_1a showing the same phenotype; A_2A_2 and A_2a showing the same phenotype)
- 15) a.-They seem to be metacentric because the centromere divides each chromatide into two arms approximately the same size
b.- They are homologous because they are pairing and also they have exchanged some genetic material as we can conclude by using some colourings (colorantes)
- 16) meiosis / gametes / allele / parent / offspring
- 17) a.- We can see four types of gametes resulting from this particular meiosis
b.- Completely linked genes are those genes when there is not crossing over between them.
For this reason, the combination of alleles in the original chromosomes -one from the father,

one from the mother- will remain in the gametes

The diagram shows the case of non-completely linked genes: genes located in the same chromosome but not too close to each other so crossing-over happens occasionally between them. Those meiosis in which crossing-over between them happens will produce four types of gametes; those meiosis in which crossing-over between them doesn't happen will produce two types of gametes

- 18) We assume it is a case of co-dominant alleles because there are three genotypes (there can be other possibilities but just to start with). And also because the proportion is 1:2:1 and this proportion can result from Aa x Aa (being A:long stem; a:short stem; both co-dominant alleles). So parents AA (long stem) x aa (short stem) will produce Aa (medium length stem)
- 19) a) The principle of independent assortment is true if the genes are located in a different chromosome so the presence of one allele in a gamete doesn't have any influence on the presence of another allele -of course, referring to two different genes). So the statement is false.
b) False. If a lethal allele were always homozygous, it would be excluded from the population -because of being lethal and not hidden-. Lethal alleles tend to be recessive and this way allows them to remain in the population when hidden under a dominant non-lethal allele.
c) Humans have 23 different chromosomes and each of them carries around 1500 genes (information to make 35000 proteins). So the statement is false.
d) Yes if trisomic people are considered. But the current situation is being diploid and having 2 alleles for the same trait.
- 20) First conclusion: dominant/recessive relation because only two phenotypes
Hornless x Hornless >> hornless Secondly: if it is always like that, hornless must be recessive; otherwise some breeding could produce a different phenotype
Horns x Hornless >> ½ horns; ½ hornless
So allele hornless (h) and allele horns (H)
hh x hh >> hh (hornless)
Hh x hh >> ½ Hh (horns); ½ hh (hornless). (c) is true.
- 21) Page 94 but be careful and don't misunderstand arms and chromatides (the label "arms" in the diagram on page 94 can be misleading and be could call those lines chromatides. A chromatides is divided into two equal or very different arms by be centromere.
- 22) ..
- 23) A chromosome map show the sequence of genes in the chromosomes of a particular species (look at diagram at the bottom of page 94). In reality this type of information is the result of a great variety of studies, included a big amount of crossings.
Another idea is how to identify a particular chromosome; for this purpose scientists use a set of dyes -colorantes- and after dying all each chromosome shows a pattern of bands as a consequence of the different nitrogenous base order in it (page 113)
- 24) X is bigger, therefore it has more genes, it doesn't determine the sex -because males have X chromosome), female mammals have two, male mammals have one
Y is smaller and has fewer genes, it contains male sex-determining genes, male mammals have one.
- 25) a) not one but two
b) not identical but different
c) not only
d) below 1°C or above 33°C
- 26) a) 8; b) 16; c) 16
- 27) white-eyed: X^r
red-eyed: X^R
X^rX^r x X^RY >> males always red-eyed; females always red-eyed
- 28) Birds have a sex determination by the model ZZ/ZW. W is a chromosome that only females

carry

29)

30) Gene mutation affect one gene. Chromosome mutations affect several genes in an area of a altered chromosome

31) will not inherit; (there is a mistake in my edition: the text talks about autosomal cells and the right idea is somatic cells); are not transmitted; it can be inherited

32) DO NOT FORGET STUDYING PAGE 100.

X-rays are physical mutagen agent; tobacco smoke is a chemical mutagen; solar radiation (UV radiation) is physical mutagen; human papilloma viruses are biological mutagen.

REVISION. Page 102

1) Biological information transmitted to the cells resulting from division can be mutations caused by exposure to the sun, instruction for the sex determination of new organisms -important if the cell resulting is a gamete-, information for the heart to develop and hair colour. Although all somatic cells have the same genetic information (hair colour, how to develop into a heart..), all cells don't develop according to the instruction because only some instructions are active in a particular type of cell.

2) Yes, mutation is the origin of different varieties and then natural selection makes its job

3) Pure-bred = homozygous, can be the offspring of two genetically different parents but also can be the offspring of genetically identical parents.

Hybrid = heterozygous; it can be the offspring of two genetically different parents

4) a.- $AA \times Aa \gg \frac{1}{2} AA, \frac{1}{2} Aa$

b.- $aa \times Aa \gg \frac{1}{2} Aa, \frac{1}{2} aa$

c.- $Aa \times Aa \gg \frac{1}{4} AA, \frac{1}{2} Aa, \frac{1}{4} aa$

5) Remember this is a trait by co-dominant alleles

aa from $aa \times aa$ or $Aa \times Aa$ or $Aa \times aa$

AA from $AA \times AA$ or $AA \times Aa$ or $Aa \times Aa$

6) green wrinkled "aall" (double recessive) can result from $AaLl \times AaLl$

$AaLl \times aaLl$

$AaLl \times aall$

$AaLl \times AaLl$

~~$aaLl \times AaLl$~~

$aaLl \times aaLl$

$aaLl \times aall$

$aaLl \times AaLl$

~~$AaLl \times AaLl$~~

~~$AaLl \times aaLl$~~

$AaLl \times aall$

$AaLl \times AaLl$

~~$aaLl \times AaLl$~~

~~$aaLl \times aaLl$~~

$aall \times aall$

~~$aall \times AaLl$~~

(I've crossed out the repeated combinations)

7) a) all cells in the plant have the same genotype

b) Sentence (b) means the same as sentence (a)

c) Mutation is at random so if there is a mutation in a cell the same mutation will not be repeated in another cell

d) Yes, this is a case of phenotype influenced by the environment

8) a) gamete cells / in the reproductive cells

b) mutagens

9) a) There are several reasons why offspring -offspring is plural- are not identical to their

parents: each parent produces an enormous variety of gametes due to processes during meiosis (crossing-over and independent assortment of chromosomes -that is distribution at random of non-homologous chromosomes-). In addition to the enormous variety of gametes each parent produces, offspring are not identical to any of their parents because every descendant has a combination of genes coming from each parent

b) phenotype is the appearance an individual shows. Some traits are due to their genotype and others are due to genotype influenced by the environment

c) Already above-explained.

d) Male mammals can not be a carrier of a trait in his X chromosome because all alleles he has in his only X chromosome will be obvious

On the contrary, female mammals can be carriers of traits in her X chromosome because a recessive allele in one of her two X will be hidden

10) a) True

b) A lot of traits have more than two alleles in the population